WHAT IS CLAIMED IS:

1. A method of administering a bioactive agent to cells of a targeted tissue site of a subject which comprises administering to said subject an effective amount of the bioactive agent as a bioconjugate, said bioconjugate comprises the bioactive agent and an organocobalt complex wherein the bioactive agent is covalently conjugated to the cobalt atom through a non-reactive atom in the bioactive agent molecule.

2. The method of claim 1, wherein said cells of said targeted tissue site have an affinity for the organocobalt complex portion of said bioconjugate.

3. The method of claim 1, wherein said cells of said targeted tissue site have an affinity for the targeting molecule of the organocobalt complex portion of said bioconjugate.

4. The method of claim 1, wherein said bioconjugate is administered intravenously.

5. The method of claim 1, wherein said bioconjugate is administered parenterally.

6. The method of claim 1, wherein said bioconjugate is administered orally.

7. The method of claim 1, wherein said bioconjugate is administered intramuscularly.

8. The method of claim 1, wherein said bioconjugate is administered intrathecally.

9. The method of claim 1, wherein said bioconjugate is administered as an aerosol.

10. The method of claim 1, wherein said targeted tissue site is neoplastic tissue and said bioactive agent is an anticancer agent.

11. The method of claim 10, wherein said neoplastic tissue is tissue of a sarcoma.

12. The method of claim 10, wherein said neoplastic tissue is tissue of a carcinoma.

13. The method of claim 10, wherein said neoplastic tissue is tissue of a leukemia.

14. The method of claim 1, wherein said targeted tissue site is tissue afflicted with psoriasis and said bioactive agent is a cytotoxic agent or anti-metabolite.

15. The method of claim 1, wherein said targeted tissue site is tissue for the application of gene therapy and said bioactive agent is an oligonucleotide or a polynucleotide.

16. The method of claim 15, wherein said oligonucleotide is antisense DNA or RNA.

17. The method of claim 1, wherein said targeted tissue site is tissue for the application of peptide therapy and said bioactive agent is a peptide or protein.

18. The method of claim 1, wherein a bolus of vitamin B_{12} is administered prior to administration of said bioconjugate.

19. The method of claim 1, wherein nitrous oxide is administered first to deplete body stores of vitamin B_{12}.

20. The method of claim 1, wherein said non-reactive atom is selected from the group consisting of a carbon atom, a nitrogen atom, an oxygen atom, a sulfur atom, a selenium atom or a silicon atom.

21. The method of claim 1, wherein said non-reactive atom is a carbon atom.

22. The method of claim 1, wherein the non-reactive carbon atom is a carbon atom from an alkyl, acyl or aryl group that will not lead to rearrangement or destruction of the bioactive agent under conditions of ligand exchange during receptor-mediated endocytosis.

23. The method of claim 1, wherein said bioactive agent is covalently bound directly to the cobalt atom of the organocobalt complex.

24. The method of claim 1, wherein said bioactive agent is covalently bound indirectly to the cobalt atom of the organocobalt complex via a spacer.

25. The method of claim 24, wherein said spacer is a self-destructing linker.

26. The method of claim 1, wherein said bioactive agent is a diagnostic compound.

27. The method of claim 1, wherein said bioactive agent is a drug.

28. The method of claim 27, wherein said bioactive agent is an anticancer agent.

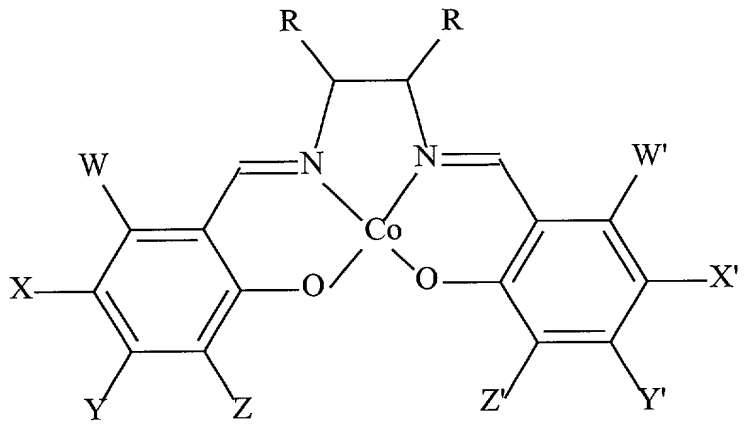
29. The method of claim 1, wherein said bioactive agent is a peptide, peptide analogue, protein or protein analogue.

30. The method of claim 1, wherein said bioactive agent is a nucleic acid or a nucleic acid analogue.

31. The method of claim 30, wherein said nucleic acid or nucleic acid analogue is a polynucleotide, oligonucleotide, antisense DNA or antisense RNA.

32. The method of claim 1, wherein said organocobalt complex is cobalamin, a cobalamin derivative or a cobalamine analogue.

33. The method of claim 1, wherein said organocobalt complex is a compound having the following formula:



wherein the substitutents may be included or omitted to modulate physical properties of the molecule, e.g., water solubility, stability or λ_{max} -- the wavelength at which the complex absorbs.

34. The method of claim 33, wherein said targeting molecule is selected from the group consisting of glucose, galactose, mannose, mannose 6-phosphate, transferrin, cobalamin, asialoglycoprotein, α-2-macroglobulins, insulin, a peptide growth factor, folic acid or derivatives, biotin or derivatives, $YEE(GalNAcAH)_3$ or derivatives, albumin, texaphyrin, metallotexaphyrin, a vitamin, a coenzyme, an antibody, an antibody fragment and a single-chain antibody variable region (scFv).

35. The method of claim 1, wherein said organocobalt complex is selected from the group consisting of organo(pyridine)bis(dimethylglyoximato)cobalt, a corrinoid, derivatives thereof and analogues thereof.

36. The method of claim 1, wherein said organocobalt complex comprises a multiple unsaturated heterocyclic ring system bonded to a cobalt atom through 4-5 nitrogens and/or chalcogens which are part of said ring system.